Teaching Perioperative Medicine to Residents

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ABSTRACT

- *Objective:* To examine the effectiveness of 3 methods of teaching perioperative medicine to residents.
- *Methods:* Residents were given pre- and post-rotation tests and confidence surveys. Year 1, the medical attendings were instructed to teach a set of PowerPoint modules as a core consult curriculum; year 2, the senior medicine residents were instructed to teach the modules, in conjunction with the attending. In year 3, a 1.5-hour interactive pretest review session, with an introduction to the modules, was added. The modules were then opened to everyone on service for self-study and/or teaching. Residents and attendings were still encouraged to use the modules as a core teaching curriculum.
- *Results:* Sixty residents participated—18 the first year and 21 each in years 2 and 3. The mean pretest scores were 56.8% to 58.4%. With attending and resident teaching, the average posttest score rose to 73%. Adding a pretest review session and inclusive module availability, the average posttest score rose to 85.7%. The pre-rotation confidence survey scores dropped each year, from 7.1 to 6.2 to 5.3, but the post-rotation confidence scores remained at 8.0.
- *Conclusion:* Pre-rotation tests provide housestaff insight into their knowledge gaps, improving self-awareness of their practice confidence. Reviewing a pre-rotation test with the housestaff and directing them to a site of evidence-based modules and references improved knowledge beyond didactic attending and resident teaching alone.

Coinciding with the increase in internal medicine hospitalists, there has been a rapid rise in the percentage of hospitalized surgical patients who are co-managed by a medical physician. The number of co-managed patients rose 11.4% per year in a study conducted from 2001 to 2006 [1]. Practicing hospitalists note that 30% of their patients are seen in a consultative/co-managed setting [2]. In a survey of 389 internal medicine–trained hospitalists, the authors reported that residency training underemphasized perioperative/consultative medicine [3]. The Society of Hospital Medicine recognized that perioperative management is a key skill for hospitalists and now lists it as a core competency [4]. Academic medical education must evolve with the needs of medical practice [5,6].

We developed a core clinical curriculum to teach perioperative medicine to residents during the residents' month rotation on the medical consult/co-management service. Different teaching methods were trialed in an attempt to find the most effective method.

METHODS

Setting

This study was performed in a tertiary care academic hospital on the medical consult/co-management service. The service is made up of 1 medicine intern, 1 third-year medicine resident, and 1 anesthesia intern. They rotate on service monthly, and the attending rotates biweekly. Institutional review board approval for the study was obtained.

Teaching Modules

Sixteen evidence-based teaching modules were developed using PowerPoint presentation software (**Table 1**). The modules were developed by the authors on topics considered to be common, essential consult problems and were developed after review of the literature. The lengths of the modules vary from 10 to 35 slides, and they take about 20 to 60 minutes to review. Each module includes several case-based multiple-choice questions; these questions appear in the pre-rotation test (described below). Supporting evidence from the literature and references are included, as well as the answers to the questions at the end. Post-rotation test questions were developed from the information in each module. The lead author, curriculum organizer, was in charge of keeping

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Table 1. Teaching Modules

Subacute bacterial endocarditis prophylaxis
Perioperative β blockers
Preoperative medications
Cardiac stents and noncardiac surgery
Perioperative diabetic management
Preoperative cardiac evaluation
Heparin-induced thrombocytopenia
Clostridium difficile colitis
Perioperative antithrombotic therapy
Contrast-induced nephropathy
Osteoporosis and hip fracture risk
Diabetic foot infections
Pain management
Postoperative delirium
Postoperative fever
Aortic stenosis and noncardiac surgery

the modules and questions updated and current with the literature.

Teaching Methods

During this 3-year study, teaching methods were established with a yearly progression of additional methods. At the initiation of the study, the project and teaching expectations were outlined at the academic hospitalist meeting to the 10 faculty who rotate on the consult service. A packet was given to each attending at the start of their consult rotation. The packet contained the pretest and posttest with answers, a list of the modules, and instructions on how to access the module site on the hospital computer network. For the first year, only the attendings could access the modules for teaching.

During the second year, the senior residents were also given access as well as primary responsibility for teaching the team. The senior residents were given a packet at the beginning of their consult rotation that contained the pretest. After completion of the pretest, they were given the list of modules and directions to the module site. They were instructed to review the modules and pretest answers and then teach the interns. The attending on service also continued to receive the packets, but now they were asked to share the teaching responsibility with the senior resident. Teaching was done after morning rounds if completed early, or after lunch. There were 16 modules for a 1-month rotation, allowing for almost daily weekday teaching sessions, but also allowing for busy consult days and resident clinic schedules.

In the third year, all of the house staff on the consult service first received the pretest and the confidence survey. After the pretest was completed, they attended a 1.5-hour interactive pretest review session led by the curriculum organizer. The test questions were reviewed and self-graded. As the test questions were discussed, individual module slides containing the pertinent information were accessed from the computer network file and shown on an overhead screen. The entire set of modules and references were thereby briefly introduced. The entire team was then given access to the modules on the hospital computer network for further reference and more in-depth self-study and teaching.

Program Evaluation

Pre-rotation and post-rotation tests were used to quantify the knowledge base at the beginning and end of the rotation. In the first week of service, incoming residents completed 30 clinical case-based test questions. At the completion of the rotation, the residents completed 30 different but similar questions. In addition, house staff were asked to complete a pre- and post-rotation perioperative management confidence self-assessment survey (**Table 2**). The responses to test questions were statistically analyzed in a repeated measures linear mixed model to obtain the mean scores, differences, and significance.

RESULTS

Sixty house staff participated. Eighteen received primary attending–led teaching, 21 received primary resident–led teaching, and 21 received the 1.5-hour pretest review and access to the modules. The mean pre-rotation test scores were similar in all groups, ranging from 56.8% to 58.4% over the 3 years. In years 1 and 2, the mean post-rotation test scores rose to 73.0% and 73.2% for attending and resident teaching, respectively. There was no significant difference in test scores between attending and resident teaching. Posttest scores varied between rotation groups. Some groups showed no to minimal improvement from pre- to posttest scores. When questioned, the groups who performed poorly on the tests had not reviewed the modules. Other groups, especially those taught by the curriculum developers, showed marked improvement in pre to posttest scores. Qualitative questioning of house staff

Table 2. Confidence Survey

What is your confidence level in managing:									
Perioperative diabetes mellitus									
1	2	3	4	5	6	7	8	9	10
Perioperative hypertension/hypotension									
1	2	3	4	5	6	7	8	9	10
Perioperative cardiac management and risk assessment									
1	2	3	4	5	6	7	8	9	10
Perioperative antibiotic prophylaxis									
1	2	3	4	5	6	7	8	9	10
Perioperative bleeding/thrombotic risk and anticoagulation									
1	2	3	4	5	6	7	8	9	10
Perioperative renal disease									
1	2	3	4	5	6	7	8	9	10
Perioperative fever									
1	2	3	4	5	6	7	8	9	10
Perioperative medications									
1	2	3	4	5	6	7	8	9	10
Osteoporosis									
1	2	3	4	5	6	7	8	9	10
Orthopedic infections									
1	2	3	4	5	6	7	8	9	10

revealed that attending and resident teachers varied in their commitment to using the modules and to teaching.

In year 3, all house staff on the rotation received the pretest review session and module access. The mean post-rotation test score rose to 85.7%, with a significant 27.3-point difference ($P < 0.001$) between the pre-rotation test scores and the post-rotation test scores. There was also a significant 11.1-percentage point improvement ($P = 0.001$) above the attending- and resident-led teaching (**Table 3**).

The mean post-rotation confidence scores for all 3 groups were not significantly different (8 on a 10-point scale). However, the mean pre-rotation confidence scores declined over the 3 years, beginning at 7.06 the first year and dropping to 6.22 the second year and 5.3 the third year (**Table 4**).

DISCUSSION

In 2008, the internal medicine consult service at this academic center evolved into a consult/orthopedic co-management service. During this time, numerous articles were published about the evolution of co-managed care and how to organize, establish expectations, and define the clinical benefits [7–10]. Just as the emphasis on primary care physicians to be more productive and efficient in the outpatient setting accelerated the utilization of hospitalists for inpatient care, so too the emphasis on surgeons to increase productivity, efficiency, and quality accelerated the internal medicine co-management movement [11].

Co-management rose in importance in the academic setting when the Accreditation Council for Graduate Medical Education (ACGME) established resident work-hour restrictions [12]. With surgical resident coverage limited, co-managing internists took a more responsible role in managing problems, responding to acute nursing issues, and writing orders. This is in contrast to a consultant, who leaves recommendations, does not write orders, and does not receive nursing calls. But in addition to the work processes system management that co-management addresses, internal medicine co-management is also responding to the increasing age and complexity of surgical patients. Over the next 20 years, surgery-related costs and surgical complications are expected to rise significantly [13]. Studies have shown that co-management has positively influenced

Table 3. Pre- and Post-Rotation Mean Knowledge Test Scores

	Score (Number of Tests Scored)			
Teaching Method	**Pre**	**Post**	**Difference**	***P* Value**
1.5-hr pretest review	58.4% (21)	85.7% (21)	27.3%	< 0.001
Resident	57.5% (21)	73.2% (18)	15.7%	< 0.001
Attending	56.8% (18)	73.0% (16)	16.2%	< 0.001

Difference in resident vs. attending –0.51 percentage points ($P = 0.91$).
Difference in 2-hr review vs. attending +12.7 percentage points ($P < 0.001$).

Table 4. Pre- and Post-Rotation Mean Confidence Survey Scores

	Score (Number of Tests Scored)		
Teaching Method	**Pre**	**Post**	**Difference**
1.5-hr pretest review	5.3 (16)	8.0 (18)	2.7
Resident	6.22 (16)	7.67 (12)	1.46
Attending	7.06 (13)	8.12 (10)	1.07

postoperative complications, mortality, and 6-month readmission rates [14]. Co-management also has a positive correlation with surgeon and nurse satisfaction ratings [15].

As the need for internal medicine surgical co-management grew, we attempted to incorporate and standardize key elements of perioperative medicine into our internal medicine resident education by developing 16 core PowerPoint modules. Over 3 years, we adjusted and evaluated 3 methods of teaching them, assessing which method resulted in the best educational outcomes as measured by pre-rotation and post-rotation tests.

During the first year, there was a significant improvement in test scores from 57% to 73% ($P < 0.001$) pre- and post-rotation. The results were attending-dependent. Some attendings used the modules and performed sit-down didactic sessions, other did not. Posttest scores reflected the attending's commitment to teaching. In the second year, we provided an opportunity for the senior resident to take on the primary teaching role, supplementing attending teaching. The posttest scores again revealed a modest, significant improvement identical to the primary attending teaching. Again, the results were dependent on the commitment of the teacher, whether it was an attending or resident. Looking to achieve further educational improvement, after the pretest was completed, a review session was provided, and residents were given access to the modules so that they could review the material in depth at any time. A few of the residents commented that after receiving direction on the modules, they found the modules very helpful as a reference source when managing patients later in the rotation. This third model resulted in post-rotation test score improvement by an additional 11.1 percentage points above the attending/resident teaching model, resulting in a mean posttest score of 85.7%.

The post-rotation confidence score remained at 8 out of 10 for all teaching methods. The pre-rotation confidence score declined from a 7 to a 5. This result may be due to resident communication about the difficulty of the pretest relayed from prior to future residents on service. The authors believe that participation in the review session and self-grading of tests provides residents with a greater awareness of their knowledge deficiencies.

With directed self-learning and timely feedback using pretest review and teaching modules, residents attained more knowledge than when their teaching was provided by and dependent upon another individual. Some residents even developed their own modules to add to the curriculum. Future study will involve encouraging the residents on service to update old modules with the most current literature and to develop new modules for the learning file.

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